

## DETAILED ANALYSIS OF URBAN-ENVIRONMENTAL ASPECTS IN AN URBAN LIFE QUALITY MODEL

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### Abstract

The problems in both urban and environment are those that originate from the increase of urban growth and are the result of the deterioration of environmental conditions. As a place of population growth, commercial and industrial activity, cities concentrate energy and resources use and waste generation, to the point where both manmade and natural systems are overloaded and capacity to handle are overwhelmed. Therefore intends to develop a methodology to analyze the urban-environmental aspects in detailed scale and subsequent verification and justification in the different spatial scales of the city. This type of approach will enable the integration of information in each of the levels of study. The development of this research allows to verify and to substantiate homogeneous areas with different levels of vulnerability at different spatial scales of the city and detailed information and qualified at the time of making it possible to propose policies and actions for urban planning today.

**Keywords:** urban-environmental aspects – homogeneous areas of vulnerability.

### 1. INTRODUCTION

In the last years, different societal, economical and political changes that have occurred in the main Latin American urban areas, and in particular in Argentina, have transformed the urban territory and turned it into a disintegrated and degraded place to live in. In this sense, as an answer to this situation, the national, provincial and local governments should preserve in an integral way, the process

transformation of these cities, avoiding social imbalance and providing life quality to their habitants. In consequence, population's needs, such as health, housing, education, recreation and safeties have to be faced by the local governments. Therefore, it is important to count on different mechanisms which allow recognizing habitant's satisfaction and dissatisfaction. Accordingly, it is necessary to establish a conceptual and empirical methodology which allows identifying the social satisfaction and its inclusion in the scope of public policies.

The population's life quality (PLQ) is closely linked to the inhabitants' satisfaction, which is reflected into the group of needs that must be covered by the government's policies. (Leva, G. 2005). Thus, we believe that if the inhabitants' basic needs are not satisfied, from the access to basic health, sanitation, recreation, etc., the population will be unsatisfied and in disadvantage. The balance between the ecological, biological, economic, productive, socio-cultural, technological and aesthetic aspects suggests the existence of a healthy habitat capable of meeting the needs which we have already mentioned.

Understanding the urban-environmental relationship allows us to consider a number of components as part of the city: air pollution and noise, water quality, sanitation, transport conditions, preservation of green spaces, that is to say, thinking about the deteriorating conditions of life of its inhabitants. (Metzger, 1996).

ULQ also depends on the relationship between specific urban groups (habitants / users) and institutional-political system that combines territory and the activities which are carried out by people who are involved in urban metropolitan processes. Critical and "basic" variables, with a considerable influence on ULQ, are included on this relationship.

ULQ comprises three components:

- The demand consists of two groups that represent objective people's needs, housing or population sectors characterized within a cultural context, and the subjective needs represented by social preferences and personal wishes,
- The supply comprises material and non- material resources that represent regional urban properties and services, objective needs and symbolic resources,
- The relationship between the above mentioned needs and the supply.

In consequence, this work presents the development of a methodology and a model gathering different aspects that interact within the concept of urban life quality. ULQ is measured from the implementation

of an evaluation methodology, which is synthesized in a model that interprets and integrates housing and urban systems, critical resources, environment, urban life quality concepts and their territorial localization.

The design of an Urban Life Quality Model (ULQM)<sup>1</sup> has allowed to obtain the population Unsatisfied Basic Needs (UBN) where the integration of the urban services (infrastructure and basic services), the environmental aspects and the relationship between demand and supply allow to obtain quantitative and qualitative data and its urban territorialisation.

This work was carried out on the basis of a multidimensional conceptual model. Its methodology has been presented at scientific and academic meetings and projects (Rosenfeld, 2002).

The present analysis correspond to medium urban centers of different scales and consolidations, in particular, La Plata city, capital of Buenos Aires province which was chosen as a model. This city has a consolidated urban central area, and a suburb of low dwelling density, and its population is over 700.000 inhabitants. This study was designed to deepen into some operative and conceptual aspects with the aim of improving several components of the model.

Urban Life Quality Model is structured from different components which are disaggregated in urban services and equipment (ULQuse) and urban-environmental aspects (ULQuef). Each of them is composed by different levels of integration, corresponding to: L1, infrastructure services; L2, sanitation services; L3, communication services; L4, social services; L5, urban aspects and L6, environmental aspects. This rank is analyzed from three dimensions: Qualification, Coverage / Influence Area and Opinion / Perception (Figure 1). Unlike some other models (Leva, G., 2005) energetic and environmental variables related to urban dynamics, urban-regional efficiency of services and users/habitants opinion/perception are incorporated in the ULQM.

Different urban scales are defined in ULQM which allow incorporating several analysis levels. In this sense, Urban, Sectorial, Local and Punctual scales can be studied simultaneously, taking into account the complementarities between different analysis levels (Global, Particular and Detailed).

The city as a physical support includes different spatial scales (block, neighborhood, etc.) where several urban consolidations (High, Medium and Low) can be studied. These spatial scales can be defined as:

1. Urban-Regional Level (urban areas integration and its variables);
2. Sectorial Level (high, medium

<sup>1</sup> Discoli, C. (2010-2013). Urban Life Quality Model. Systematic and modeling of urban-environmental systems applied to different scales of the city, La Plata National University. Web Site: <http://www.fau.unlp.edu.ar/index.php/content/html/65>

and low areas classification); 3. Local Level (neighborhood and particular items); 4. Punctual Level (specific locations).

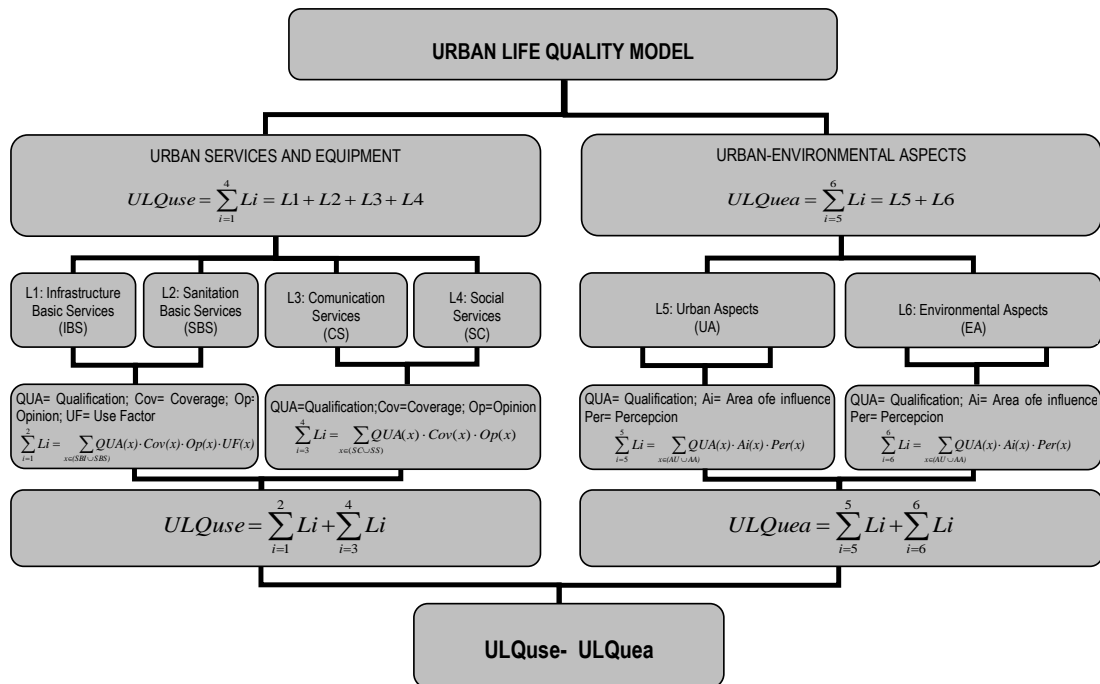


FIGURE 1 - ULQM METHODOLOGICAL AND CONCEPTUAL STRUCTURE.

Related to analysis levels, it is necessary to precise the scope of each one in order to understand their complementarity: i. Global Analysis: urban components; ii. Particular Analysis: node / residential user identified in a sector or network; iii. Detailed Analysis: particularity of each node from its specific characteristics. The study of punctual scale from a detailed analysis is carried out in this work (Figure 2).

This work pretends to analyze urban-environmental aspects (See Figure 2) in a ULQM framework related to habitants "perception" variable. From a theoretical-methodological approach, environmental pathologies qualification, influence areas and habitants type of perception, are evaluated. As an example, dumps and flood areas and air and sound pollution are exposed. Each pathology is developed at a punctual scale from a detailed analysis.

The perception dimension is studied from different information tools. In consequence a survey was developed, which allowed recognizing each pathology perception level related to the specific territory localization where it was performed.

The urban-regional perception results were obtained from a previous work (Discoli, C., 2007). The study of the pathologies at global analysis allowed recognizing representative criticality values and its convergence.

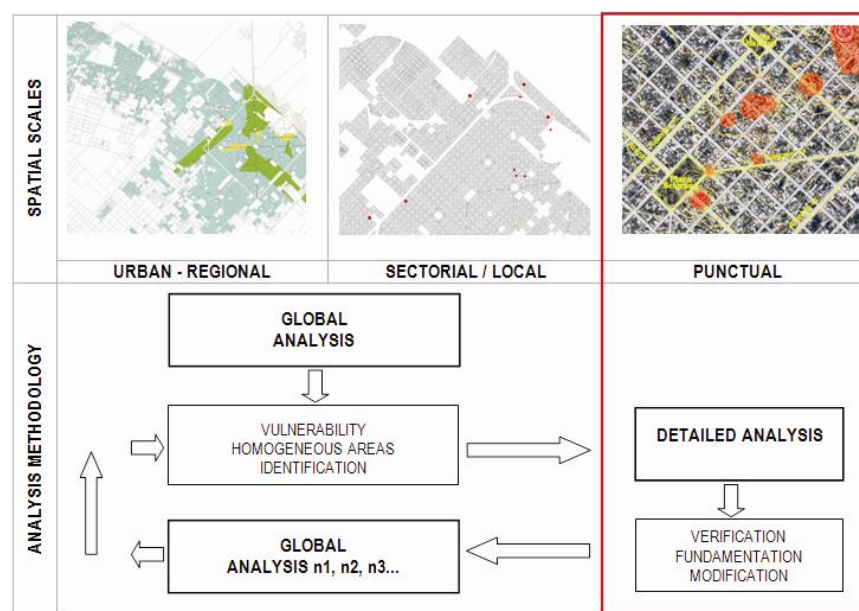


FIGURE 2 - OUTLINE OF THE PROPOSED METHODOLOGY. IDENTIFICATION AND VERIFICATION OF URBAN-ENVIRONMENTAL PROBLEMS

## 2. DATA COLLECTION TOOLS FOR THE EVALUATION OF HABITANTS OPINION/PERCEPTION

To deepen into a methodological data collection tool for habitant's opinion/perception evaluation, previous works were studied to analyze the systematization and normalization of the information. (Esparza, J., 2008).

Opinion can be defined as the belief about a particular matter. In ULQM framework, urban and equipment services are measured from the real situation (users' opinion). Unlike opinion, perception is a psychological process through senses which allow people to receive and to interpret their environment information. In ULQM, urban-environmental aspects are analyzed in an intangible way which is incorporated into one of the model dimensions. In this sense, different ways of perceiving the mentioned pathologies are a significant participation into the model algorithm and its final results.

Assessment tools led us recognize opinion/perception relevance into ULQM framework in its geo-referred situation, where habitant's territorial representation is recognized and measured. Qualification and Coverage information which comes from data collecting tools are compared and verified in this procedure.

The Opinion/Perception model structure is graphically and conceptually synthesized in Figure 3. Information sources, information data collecting tools, their processing and its possible results are defined in this figure.

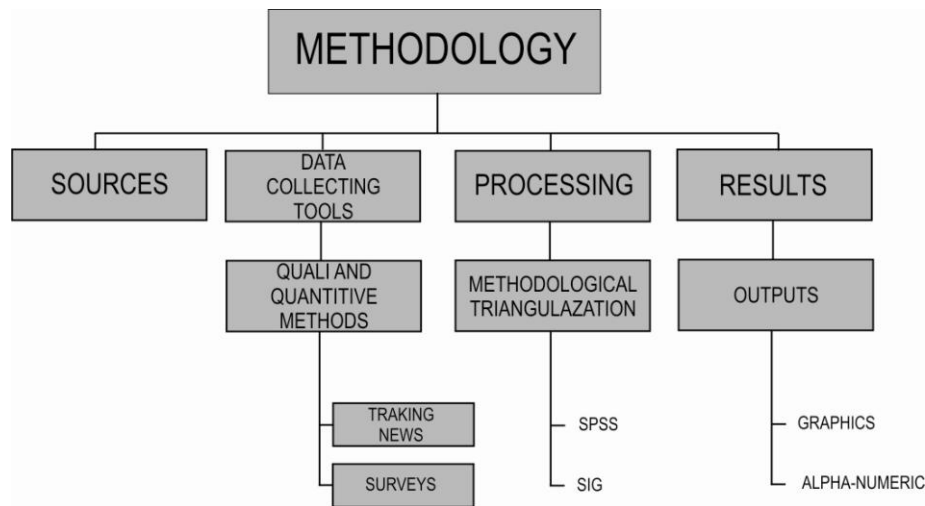


FIGURE 3 - OPINION/PERCEPTION DATA COLLECTION TOOLS. METHODOLOGICAL STRUCTURE

During information processing, methodological triangulation is carried out. As every method, it presents advantages and disadvantages in relation to the data collecting. This method led us study the same phenomenon through different tools, where several aspects are studied at the same time. Methodological triangulation as a research strategy, presents different characteristics. In this work, several information sources, which generate quantify and non-quantify data, are presented.

The development and deepening of the presented data tools as collection sources led us recognize different information utilities to measure the observed reality. Quality and quantity methods are approached and analyzed from sample surveys.

### 3. DETAILED ANALYSIS OF THE URBAN-ENVIRONMENTAL ASPECTS PERCEPTION

In previous works (Discoli, 2007) graphic outputs were obtained from the urban-environmental aspects of the ULQM at an urban-regional scale. These graphics outputs allowed us to recognize representative homogeneous areas in relation to the convergence of the mentioned pathologies. The obtained results, justifies the need of deepening in the detailed analysis of the punctual scale, where these pathologies are identified in a detailed way.

For this work, two areas from the surrounding of La Plata were identified. One, belonging to the Central Urban Area (CUA) and the other to the Periphery Area (PA). In both areas, different pathologies converge. (See Figure 4). A survey sample was developed to verify the problems which were previously identified. The systematization of the obtained information was discriminated into: Very Evident (VE), Evident (E), Little Evident (LE) and Do not Perceive (DP) and re-coded as: 0.1, 0.3, 0.5 and 1.0, respectively.



An unbundled diagnosis of real urban situation was established and homogeneous areas maps were presented from surveys results as an evaluation mechanism and as input to the model framework. Representative situations in the studied area related to habitants' dissatisfaction were recognized. Of the 84 surveys, 44 belong to CUA and 45 to PA. Some surveyed variables are shown in Table 1.



FIGURE 4 - STUDIED AREAS AT LA PLATA CITY

TABLE 1. SURVEYED VARIABLES FROM THE DETAILED ANALYSIS AT THE PUNCTUAL SCALE.

ADRESS	OCCUPATION	GENDER	AGE	OP_DUMPS	OP_FLOOD A	OP_AIR POLL	OP_SOUND POLL
39 s bet 5s and 6s	merchant	female	35	0.5	0.3	1.0	1.0
39s bet 3s and 4s	merchant	male	65	1.0	0.5	0.3	1.0
3s and 41s	merchant	female	60	0.5	0.1	1.0	1.0
3s and 43s	employee	male	52	0.5	0.1	1.0	1.0
44s bet 6s and 7s	employee	male	34	0.5	0.3	0.5	0.5

Once the surveys are georeferenced, an interpolation method (GIS) (Arc View 9) is used to identify the proximity between surveys results. Each territorialized point (survey) is incorporated, to be analyzed, by this method, which calculates the value of that point depending on its neighboring point's values. In this sense, the determination of the point to interpolate will be higher as nearest to another point with similar characteristics. (Dicroce, L., 2008). From the surveyed evaluation and its homogeneous areas identification, this work presents the detailed analysis of the habitant's perception at a punctual scale in: dumps and flood areas and air and sound pollution.

#### a. Dumps Areas

At an urban-regional level, the ULQM maps, in relation to the dumps areas allows to recognize the affection areas, taking into account the constitutive classification of its volume and its presence in time.

In relation to the detailed analysis, it was observed that complaints about dumps existence (VE, E and LE) are homogeneously distributed throughout the studied area, both the central urban and periphery area. Small sub-areas perception of affectation distribution was identified in both areas: 74 diagonal

between 4 (four) street and 5 (five) street in central urban area and 490 street between 20 street and 21 street at periphery area. See Figures 5 and 6.

Obtained results in relation to graphics and numerical outputs led us distinguish that dumps existence is recognized by the 45 % of respondents at urban center and periphery areas. Concerning VE, E and FE perceptions at urban center area (those answers where dumps existence is recognized) only 15 % of respondents is considering that is very evident. Unlike, at periphery area, that percentage rises to 23 %, due to habitual garbage collection (only three time a week). See Figures 7 and 8.



FIGURE 5 – DUMPS AT CENTRAL URBAN AREA



FIGURE 6 – DUMPS AT PERIPHERY AREA

Concerning dumps existence perceptions in both city areas, the answers were referred to garbage accumulation related to visual pollution, with 50 % of results bellowing to central urban area and 75 % at periphery area. Moreover, garbage collection company performance and sweepers workers were considerate as the causes of accumulation garbage by the responders. See Figures 9 and 10.

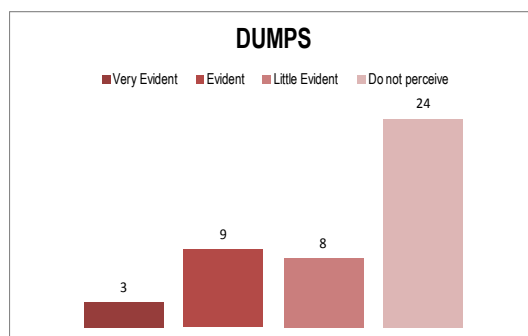


FIGURE 7 - DUMPS PERCEPTION AT CENTRAL URBAN PERIPHERY AREAS CENTRAL AREAS



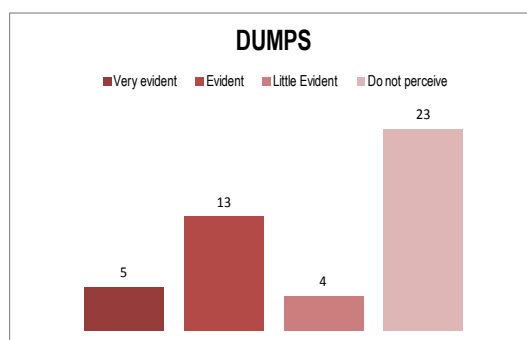


FIGURE 8 - DUMPS PERCEPTION AT PERIPHERY AREAS

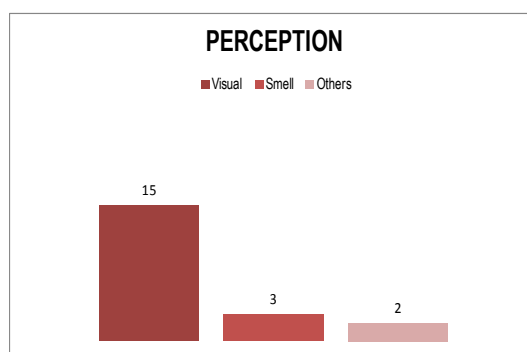


FIGURE 9 - DETAILED ANALYSIS IN DUMPS AREAS AT CENTRAL URBAN AREA

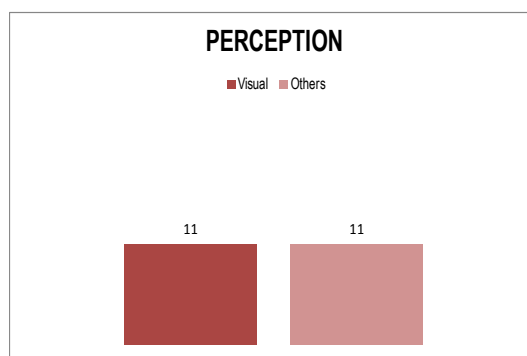


FIGURE 10 - DETAILED ANALYSIS IN DUMPS AREAS AT PERIPHERY AREA

It must be pointed out that this rate of affection is not perceived by a considerable number of responders, probably because of the habituality of living in a degraded environment.

#### b. Flood areas

To evaluate flood areas at urban-regional level, results were identified from water risk maps (CISAUA, 2006).

In the detailed analysis at local level, we can observe that the unfavorable perception results, as well as in dumps areas, they are homogeneously distributed throughout the studied area, with small concentrations on the main roads and accesses. In central urban area, complaints are located in 74 and

77 diagonal. In periphery area, we can visualize them on General Belgrano road, 485 street and 25 avenue. (See figures 11 and 12).



FIGURE 11 - FLOOD AREAS AT CENTRAL URBAN AREA



FIGURE 12 - FLOOD AREAS AT PERIPHERY AREA

In both studied areas, we can observe that the 45 % of respondents recognize the existence of flood areas. In central urban area, a “Very Evident” perception reaches 24 %, while in periphery area it increases to 32 %. This problem affection is not perceived by a considerable number of responders, although problems actually exist. See Figures 13 and 14.

In central urban area, flood is the result of the bad functioning of the drainage system for waste acumulation in public places. It must be pointed out that the converse of the two pathologies (dumps and flood areas) are identified. In periphery area, many habitants think that flood areas are related to streams maintenance and stormwater infrastructure (ditches, gutters and storms drains). See Figures 15 and 16.

In this sense, the origin of each problem in every studied area is recognized by pathologies congruence and their territorial location. While, failure in drainage system is an urban problem (at high consolidation), streams maintenance occur only at semi-urban areas (at low consolidation).

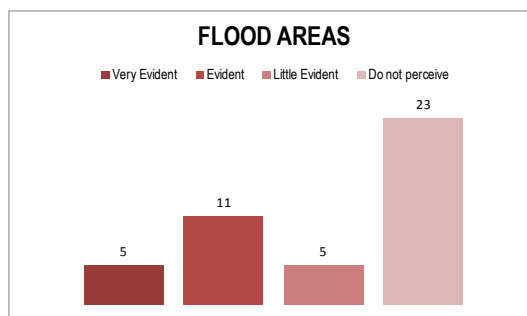


FIGURE 13 - FLOOD AREAS PERCEPTION AT CENTRAL URBAN AREA PERIPHERY

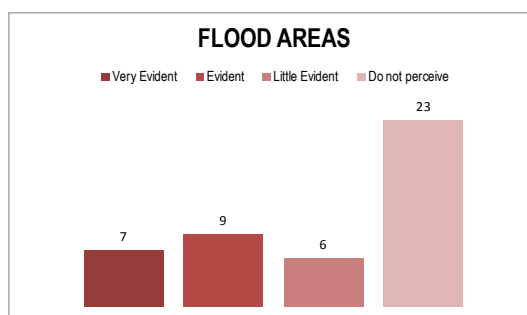


FIGURE 14 - FLOOD AREAS PERCEPTION AT PERIPHERY AREA

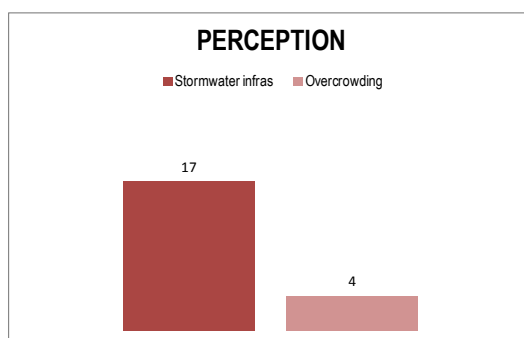


FIGURE 15 - DETAILED ANALYSIS IN flood AREAS AT CENTRAL URBAN AREA

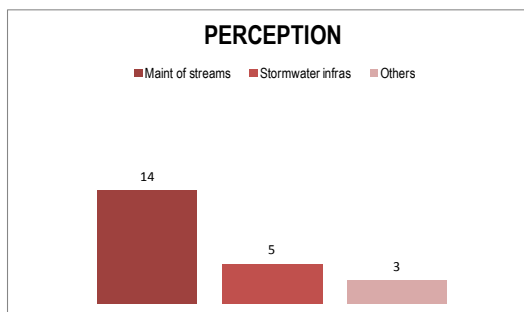


FIGURE 16 - DETAILED ANALYSIS IN FLOOD AREAS AT PERIPHERY AREA

### c. Air Pollution

To evaluate air pollution at an urban-regional level, PM<sub>2,5</sub> particles emissions in transport fuel consumption on main roads are measured. On the other hand, it must be pointed out that significant

emissions from industrial sector are located in our studied area. This information, led us recognize the affection homogeneous areas. (Discoli, C., 2007).

In the detailed analysis at punctual scale, the results in relation to air pollution were identified on main roads and access in both studied areas (central urban and periphery areas). This pathology is manifested through smell and fine dust which were found throughout the studied area. See Figures 17 and 18.



FIGURE 17 - AIR POLLUTION AT CENTRAL URBAN AREA

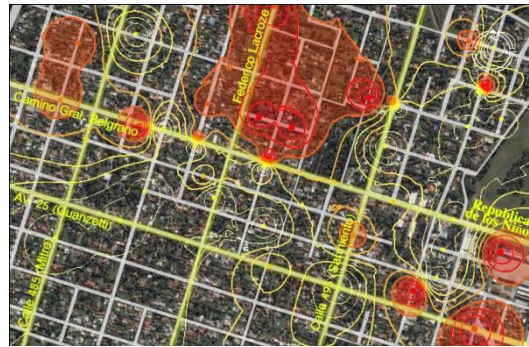


FIGURE 18 - AIR POLLUTION AT PERIPHERY AREA

At central urban area, air pollution was detected by the 61, 4 % of surveyed habitants, which 27, 3 % declared "Very evident". Unlike, the periphery area, this pathology was detected by the 58 % of surveyed habitants, where the 22, 2 % of those responses were "Very Evident".

On the other hand, a low percentage of the surveyed people do not perceive any pollution, probably due to people habituation of the place where they live. See Figures 19, 20, 21 and 22.

Graphic outputs as well as perceptual results of air pollution show certain similarity in both urban areas in relation to the distribution and the perception source (smell and fine dust).

At central urban area, this pathology is perceived by the transport and industrial emissions (YPF Industry which is near from the studied area) and at the periphery area, it is perceived by the sewer and service station area. Dust scattering due to building materials from the studied area are perceived in a lower percentage.

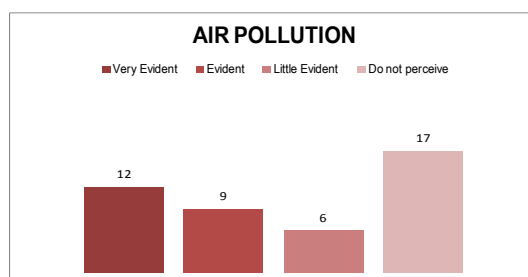


FIGURE 19 - AIR POLLUTION PERCEPTION AT CENTRAL URBAN AREA

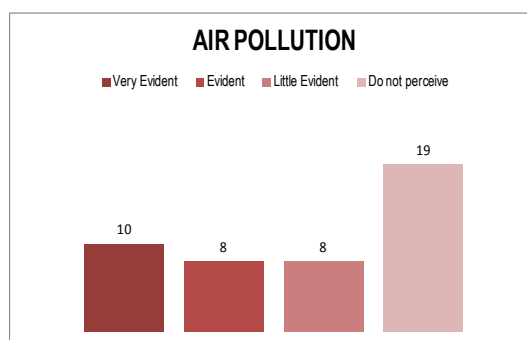


FIGURE 20 - AIR POLLUTION PERCEPTION AT PERIPHERY AREA

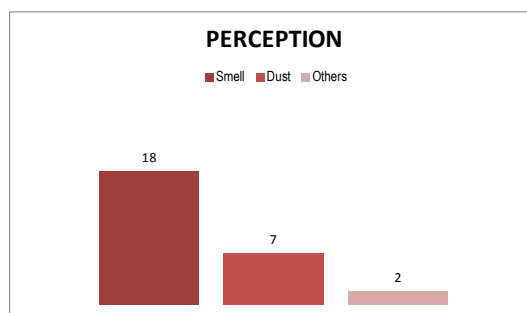


FIGURE 21 - DETAILED ANALYSIS IN AIR POLLUTION AT CENTRAL URBAN AREA

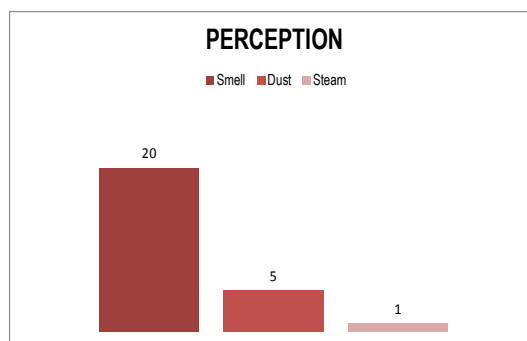


FIGURE 22 - DETAILED ANALYSIS IN AIR POLLUTION AT PERIPHERY AREA

#### d. Sound Pollution

To evaluate urban-regional sound pollution, the main sound sources and its affection level were studied. Maximum levels, both from the night and the day, were obtained from local ordinances (Ordinance Number 39.025/83, 1983 and Number 7845/91, 1991).

In both studied areas at punctual scale analysis, the results have demonstrated that complaints are on main roads. The highest percentage is on central urban area, more precisely on Italia Square and in the commercial area between 74 Diagonal and 7 and 13 avenues. On the other hand, the percentage on sound pollution at periphery area was lower, although it is also perceived on main roads as General Belgrano Road and 25 Avenue. While at central urban area the percentage of surveyed people rises to 84 %, at periphery area, it only rises to 58 %. See Figures 23 and 24.





FIGURE 23 – SOUND POLLUTION AT CENTRAL URBAN AREA

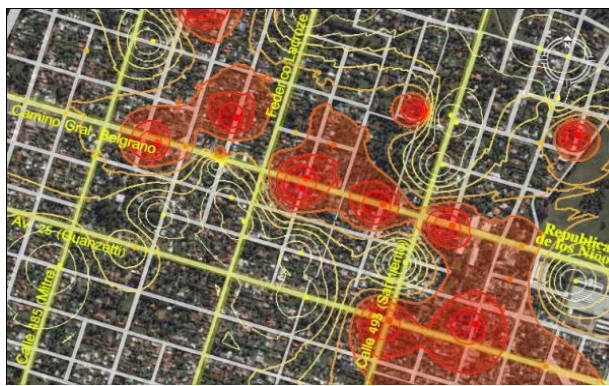


FIGURE 24 - SOUND POLLUTION AT PERIPHERY AREA

Unlike the rest of the variables (dumps and flood areas and air pollution), in this pathology we can find the largest number of complaints. For example, at central urban area, only the 16 % of surveyed people do not recognize the existence of this pathology. See Figures 25 and 26.

In both studied areas, most of the complaints are related to horns and engines vehicles. At central urban area, in addition to described complaints, we can mention those related to pubs noise and public administration buildings which convoke a lot of people. See Figures 27 and 28.

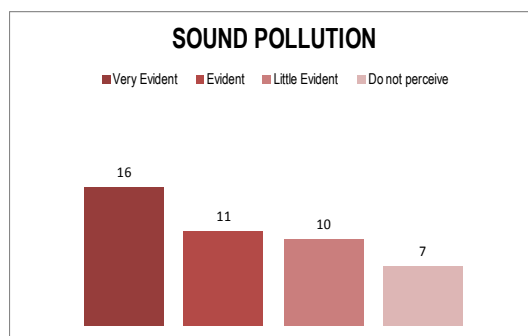


FIGURE 25 - SOUND POLLUTION PERCEPTION AT CENTRAL URBAN AREA



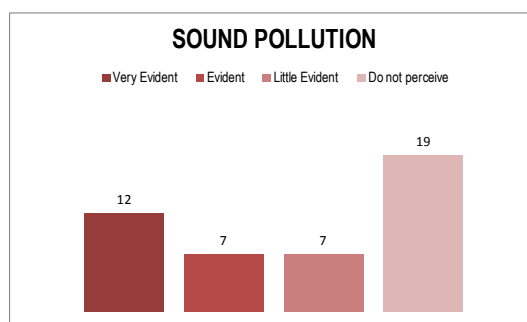


FIGURE 26 - SOUND POLLUTION PERCEPTION AT PERIPHERY AREA

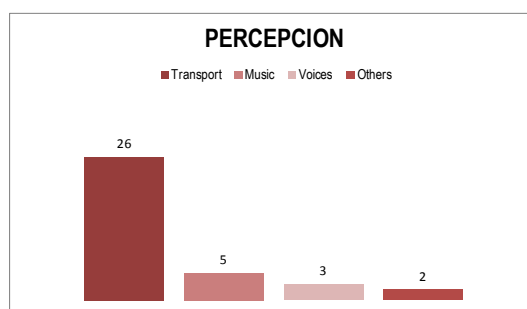


FIGURE 27 - SOUND POLLUTION DETAILED ANALYSIS AT CENTRAL URBAN AREA

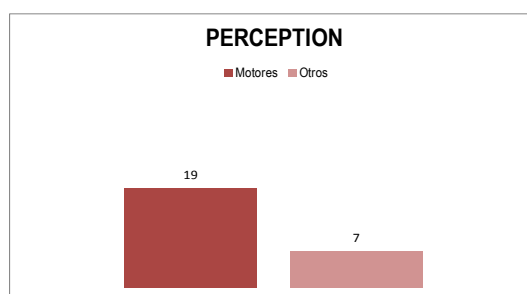


FIGURE 28 - SOUND POLLUTION ANALYSIS AT PERIPHERY AREA

#### 4. CONCLUSIONS

The deepening in the analysis of the ULQM in different spatial scales of the city (urban-regional to punctual) from urban-environmental model aspects evaluation led us quantify and qualify the results with an acceptable approximation from an observed reality. This methodology brings us the elements and information to evaluate the variables involved in the ULQM.

ULQM indexes with geographical localization at a regional and global analysis allow the quantitative evaluation of people basic needs. The incorporation of model dimensions which represent real life components allow us to analyze and evaluate the real situation and to consider possible actions to urban planning.

GIS output maps at punctual scale allowed us to recognize their environmental problems causes and magnitudes in each studied area.

Unlike urban-regional study, where ULQM indexes have allowed identifying homogeneous areas with convergent pathologies, punctual analysis perception is presented as a measurable tool. Perception detailed study led us to recognize and deepen, more specificity, those analyzed variables which were not identified at urban-regional scale. Main pollution sources and their territorial location are identified from this mentioned analysis. See Figures 29 and 30.

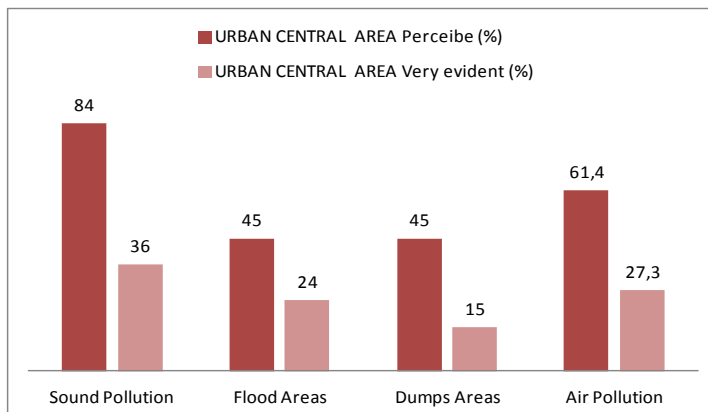


FIGURE 29 - CENTRAL URBAN AREA PERCEPTION PERCENTAGES

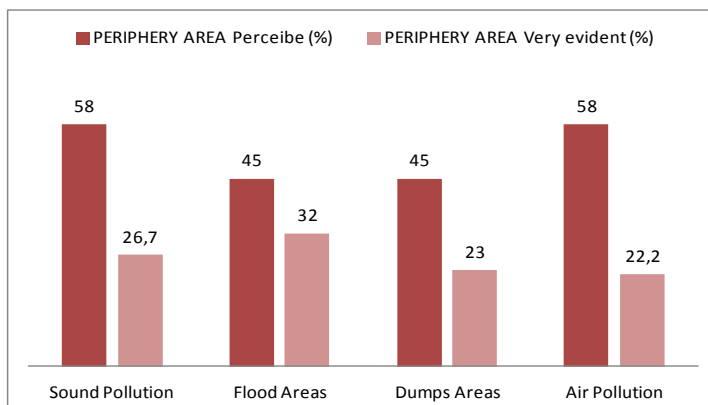


FIGURE 30 - PERYPHERY AREA PERCEPTION PERCENTAGES

Worth mentioning that the development of a methodology which is based on the urban-environmental detailed analysis, allows to work with updated information, and therefore, with a greater degree of approximation related to observed reality. This allows to redefine the identified areas and to reassign new values to the analyzed variables.

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